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Hal's DCE Cell Manager:
An Evaluation

B. McClure

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HaL's DCE Cell Manager: An Evaluation

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ABSTRACT

This report describes an evaluation of the Cell Manager, a software product from HaL Software, which simplifies the tasks of managing and administering a DCE cell.

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Executive Summary

Managing and administering an Open Software Foundation (OSF) Distributed Computing Environment (DCE) Cell can be a difficult and time consuming task. HaL's DCE Cell Manager is a product designed to make the administration task easier. This report describes an evaluation of the Cell Manager.

The Cell Manager is evaluated and found to be a useful tool for easing the burden of DCE cell administration. Several problems and potential problems are identified.

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1. Introduction

The Open Software Foundation's Distributed Computing Environment (DCE) was conceived to provide solutions to many of the problems encountered in implementing distributed systems, including:

- Scalability
- Interoperability
- Security
- Reliability
- Manageability

Although the early releases of DCE address the first four items reasonably well, the last, namely Manageability was not addressed to the same degree. DCE release 1.0.2 includes several command line utility programs (eg: rgy_edit, cdsdp, rpccp, and acl_edit) but these have a poor user interface. Some of the vendors of DCE shipped extensions to these tools with graphical user interfaces. Other vendors extended their system management programs to include some DCE features, and yet others produced products entirely dedicated to the management of a DCE cell. Refer to [1] for background understanding of DCE.

DSTO Task ADF 94/151 (Distributed Systems Technology) includes research into Distributed Systems and Distributed Systems Management, and development of prototypes[2,3] that demonstrate the potential of the Open Software Foundation's (OSF) Distributed Computing Environment (DCE) technology for meeting C3I system requirements¹.

This report describes an evaluation of the Cell Manager, a software product from HaL Software, which simplifies the tasks of managing and administering a DCE cell. The evaluation of the HaL Cell Manager served three objectives:

- To gain a better understanding of the current state of DCE cell management.
- To become sufficiently familiar with the Cell Manager to be able to comment on the quality and usefulness of the product.
- To communicate the findings to relevant areas in the ADF and DSTO.

NOTE¹: The work reported here was undertaken as part of DSTO's participation in the Cooperative Research Centre for Distributed Systems Technology.

1.1 What Is DCE Cell Management ?

According to Langsford and Moffett[2] there are three categories of Information Technology (IT) management that need to be considered:

- Management of hardware and software, including system software and applications software
- Management of system support services, such as naming, addressing, controlling system access, accounting, security and audit
- Management of user support services, such as those for troubleshooting and training

DCE is organised into administrative domains called cells. A DCE cell consists of a security service, a Cell Directory Service (CDS), a Distributed Time Service (DTS), and possibly a Distributed File Service (DFS). Although these services may be distributed across computers in a cell, they appear to the user as a centralised set of services. In addition to the DCE services, a DCE application relies upon communication services, operating system services and possibly other services such as the availability of Database Management Systems.

The manager of a DCE application must ultimately be able to configure, monitor, troubleshoot and maintain all of the software components upon which the application relies.

This report is concerned with the day to day management of a DCE cell, involving all three of the above categories.

1.2 The Importance of Distributed System Management

Managers of Distributed Systems are demanding better tools to help them do their jobs. In [3], Phillip Gill states:

‘Vendors themselves are well aware that they have a ways to go before they deliver integrated products for distributed-computing environments that live up to the expectations of users, who want to duplicate the coordination they can exercise in the legacy mainframe data centre, but in the more loosely structured networked environment’.

As more and more large corporations move their information systems from mainframe environments to client/server or distributed environments, the need for system management becomes vital. In a distributed system, the number of computers and different types of computers is larger, and therefore more difficult to maintain. In a DCE system, the task of the management system is easier because DCE hides some of the complexities of multiple platforms, and provides a consistent naming and security system. The ongoing management of the system, however, is no less important.

2. Overview Of HaL Cell Manager

The HaL Cell Manager was designed with the single intent of managing a DCE cell and DCE applications. Cell Manager is available on a variety of platforms including HP, DEC Alpha (OSF/2), IBM AIX, and Solaris. There are two main components of the cell manager, agent software (which must be installed on every computer in the cell) and the management software which has a number of components. The following diagram shows the architecture of the cell manager software.

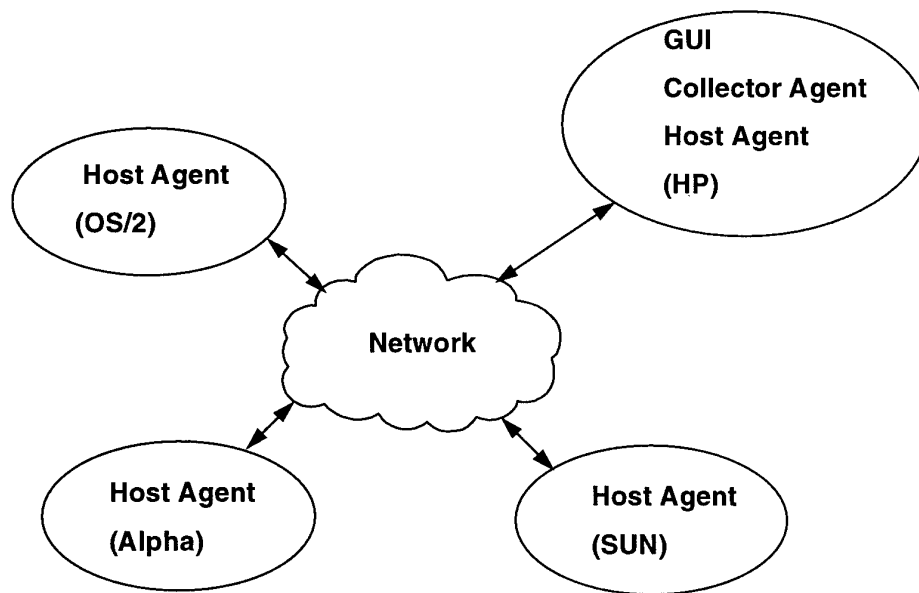


Figure 1: Architecture of the Cell Manager software

For the evaluation, the cell manager Graphical User Interface (GUI) software was run on a HP computer, with Motif as the GUI platform. From the user's point of view, the GUI depicted in Figure 1 is further divided into four components: the Namespace Manager, the Configuration Manager, Security Manager and the DCE Cell Manager Launcher. The following sections give an outline of each of these four components.

2.1 DCE Cell Manager Launcher

The DCE Cell Manager Launcher is a small window with a button to launch the other components of the Cell Manager. A help button is also available on this window.

2.2 Namespace Manager

When started, the Namespace Manager displays a graphical tree representation of the CDS database. There are icons representing the different types of CDS entries. The user can then click on any icon and expand or contract parts of the tree. From the menu, a search can be performed to find a particular entry. Entries can be added, deleted and properties modified by selecting an entry and either right clicking the mouse or selecting the appropriate menu item. Server entries can be "pinged" to see if the server is currently responding. The Namespace Manager also provides a convenient way to edit the Access Control Lists (ACLs) associated with CDS entries. CDS Clearinghouses and Replicas can be created, deleted and changed. The CDS namespace can also be backed up to a specified directory using the Namespace Manager.

2.3 Configuration Manager

The Configuration Manager is used to monitor and maintain the DCE cell configuration. The display has two windows. The first window shows a list of the computers in the cell and associated information in a table. Attributes selected from the following list are displayed, depending on the display configuration. The user can enable or disable display of any of the items to make the display more meaningful and manageable. Available attributes are:

- Architecture
- Average Load
- Comments
- Host Alias

- IP Address
- OS Name
- OS Release
- OS Version
- Processor
- Up Time

The second window shows information depending on which view is selected in the first window, from the following possibilities:

- DCE status
- DTS status
- RPC Mapping
- Cached Clearinghouse status
- CDS Clerk status
- CDS server status
- Ping

This information is only displayed for the hosts(computers) which are selected in the first window. A whole range of actions can be carried out upon the hosts in the cell such as monitoring, pinging, filtering the display, and changing the DCE configuration of a host from the Configuration Manager. These will be discussed further in Section 4.

2.4 Security Manager

The Security Manager display is a two window display similar to that of the Configuration Manager. The Security Manager is used primarily to view and manipulate information in the DCE cell security registry. The display can be filtered and searches performed which helps significantly when the registry is large. The right window can be used to display attributes associated with the items in the left window. For example, if the left window is displaying groups, the right window could display all of the members of a selected group, and some associated attributes for each of those members. All of the entry types can be manipulated (added, deleted, attributes

changed). For example, a principals full name attribute can easily be changed using the GUI based tool. The left window can be used to display one of the following:

- Organisations
- Groups
- Principals

There is also a tree-graph display of the security registry which can help to visualise the registry contents. From the tree-graph display, ACL's for the various types of registry entries can be modified.

From the main Security Manager menu, the registry can be backed up. This process simply puts the master database into maintenance state while the user copies the various files to a backup directory. The master database can then be returned to operational state.

3. Methodology

The evaluation of the HaL Cell Manager took place over a period of 30 days, using a free evaluation license from HaL, using version 1.1c. Version 1.5 of Cell Manager was due to be released shortly after the test was completed. The main GUI tool and the Coll_Svr software were installed on a HP computer and Host_Svr (agent) software was installed on each of the DEC Alpha, Sun Solaris and OS/2 platforms.

The software was exercised by performing the duties which are commonly required to maintain the cell, such as adding and deleting principals, directories and server entries. Also, the features specific to Cell Manager were tested, such as monitoring, logging and backing up. Refer to Table 1. for a complete list of functions evaluated.

Cell Manager Functions / Areas Evaluated
Overall
Useability
Reliability
CDS
General Display / Useability
Display and Edit Directories
Display and Edit Servers
Display and Edit Groups/Profiles
CDS Backup support
SECURITY
General Display / Useability
Display and Edit principals
Display and Edit accounts
Display and Edit Organisations
Display and Edit groups
Display, Edit and Verify ACLs
Security Backup support
Application / Cell Configuration Management
Test / ping hosts
Warning upon failure
Monitoring and Logging DCE status
Synchronising time

Table 1: Cell Manager Functions / Areas Evaluated

The purpose of this approach was to gain a level of confidence that Cell Manager performed as expected both in terms of function and response times. The Cell

Manager was left in the logging state for a considerable period of time to evaluate the stability of the product.

3.1 Stress Test

Using the password import function of the Security Manager, a large number (1000) of principals were added to the security registry, displayed and deleted, to test the scalability of the product. This function simply calls the passwd import command of the rgy_edit command line utility. A passwd and group file were created specifically for this test. The names of the principals were all the same, with the exception that a number was appended to the end. The numbers were in ascending order in the passwd file. A similar naming scheme was used for each of the 50 groups in the group file, with 20 principals per group making up the 1000. In addition, the user IDs (uids) and group IDs (gids) were assigned so that no conflicts would occur with the existing principals and groups in the cell registry.

The evaluation was conducted by a person familiar with DCE and DCE cell administration using the command line tools. It is expected that in most cases the users of the Cell Manager would be cell administrators and they would be familiar with DCE cell administration concepts.

4. Results

4.1 The Installation Process

There were several minor problems in the installation of the Cell Manager. First, after the software was delivered, it was realised that software license codes were required in addition. When the license codes were obtained, they were not accepted by the license server. A second set of codes were obtained and finally the Cell Manager could be started.

The second problem was with the agent software that was to run on the OS/2 computer. The first two versions that were sent had a severe error in the installation program that prevented the OS/2 agent software from being installed. After a third version of the program was obtained, the OS/2 computer could also be managed from the Cell Manager. This mainly affected use of the Configuration Manager.

4.2 Useability

The Cell Manager represents a great increase in useability compared to the command line utilities provided with DCE 1.0.3. The operator can visualise the namespace and the security registry. Monitoring can be left on and at a glance, an operator can see if a major problem has developed in the cell. The ability to easily edit CDS and Security information, and remotely configure DCE are very useful features of the Cell Manager.

There are a number of areas of the Cell Manager user interface that could be improved. For example, the actions required to modify the full-name of a principal were not immediately obvious from the Security Manager display. In several cases, such as adding many users to a single group, it is not possible to select the group from a list, the information must be keyed in (or copied and pasted) each time. The actions required to view and modify RPC mappings are not intuitive. The author expected to find RPC mappings by clicking on, or selecting a menu item while having a CDS entry selected, in the Namespace Manager. It turned out that RPC mappings are accessible only from within the Configuration Manager. This points out another weakness, that the components of the Cell Manager could be better integrated. The tool lacks some GUI features which would be expected in a mature product. For example, when attempting to import principals and groups from group and passwd files, the user must enter the path to these files. There is no facility to browse the directory structure using a "find file" dialogue box.

In some situations, the Cell Manager just reports the last DCE error that was returned to it while executing some DCE commands. This can be misleading but in one case at least, the help system provided some hints. The operator is not left stranded, since he or she can turn on command logging, re-try the operation and then browse through the command log to see where the problem started.

The help system is quite extensive and useful. For the most part it was unnecessary, since the design and layout of most of the buttons, displays and menus is self-explanatory.

When the user's security ticket expires, the user is left with no option but shutting down the entire cell manager and starting it again. It would be better if the user was given a choice of being able to either:

- Select a menu option, and re-enter their username / password pair.
- Store their password in a DCE keyfile and give the Cell Manager access to that file so that it could automatically refresh the user's credentials.

4.3 Performance and Response Times

4.3.1 Namespace Manager

The Namespace Manager takes a significant time to load (approx 30 secs in the case of this test). It reads a large amount of information from the CDS database. This did not stop the tool from being used effectively, but the test cell is a small cell with relatively few entries in the CDS. It seems likely that in a large, busy cell the performance of the Namespace Manager would be poor.

The ability to display CDS directories, Server Entries, simple entries, groups and profiles is very good. The ability to add, delete and modify these types of CDS objects is as expected. Further, no problems were experienced in modifying ACLs associated with CDS entries.

The ability of the Namespace Manager to "ping" selected servers' entries was tested. Although this function works, the dialogue box that displays the results can be confusing. In one case a server entry had two bindings exported to it. One of these bindings was for a server which was no longer running. The first dialogue to be displayed said that an error had occurred, even though the user knew that a valid server was running.

The CDS clearinghouse and replica functions of the Namespace Manager were not tested. The backup capability was tested and found to work.

4.3.2 Security Manager

The performance of the Security Manager was generally good. The time to load the Security Manager was approximately 30 seconds. As with the Namespace Manager this did not hinder its use but implies that the Security Manager would perform poorly in a large cell. The Security Manager performed well at the day to day tasks such as displaying, adding, deleting and modifying DCE registry objects (principals, accounts, organisations and groups). The user actions required to perform the various actions on these registry objects are more intuitive than the `rgy_edit` command line utility.

The ability to modify ACLs associated with objects in the security registry is convenient. This facility was tested and found to work correctly. The backup capability of the Security Manager was also found to function correctly. However, in contrast to backing up the CDS, when the security registry is backed up, the administrator must manually copy the appropriate files to a backup location. This is inconsistent with the Namespace Manager.

In order to stress test the Security Manager, one thousand principals(users) were added to the cell using the import function. The import was successful and took approximately five minutes. Display of the registry information was not slowed appreciably by the increased number of principals. The filtering available made it possible to filter out all of the 1000 principals (since they were all members of the test organisation) and look at the other principals. Deleting the principals was a simple action, but took one hour to complete. The groups associated with the 1000 principals were then also deleted from the registry.

For comparison with Security Manager, a shell script was created that deleted the principals from the registry directly using the `rgy_edit` command. The `passwd_import` command was also used directly to add the 1000 users back to the registry. Using this technique, it took approximately 4 minutes to add the 1000 users and 6 minutes to delete them. The 6 minutes taken to delete the principals contrasts sharply with the 1 hour required by the Security Manager. This is thought to be due to the fact that the Security Manager was updating the display for every addition/deletion.

4.3.3 Configuration Manager

The Configuration Manager is able to report on the state of the hosts in the DCE cell correctly. This information includes:

- How long the host has been up
- Which DCE daemons are running
- The state of DTS(time) on each host

The Configuration Manager can be setup to poll the agent software at regular intervals and update the status display. This information can also be logged to file. However, there is no time stamping in the log files which is a serious oversight. There is no capability to measure load or response time of either DCE servers or Application servers. There is no capability to graph status or performance over time. Despite these shortfalls, the product is quite useful to troubleshoot a DCE cell without having to visit or log into each host in the cell.

In one case, while the Configuration Manager was left in a monitoring state, one of the computers in the cell was re-booted by its user. The particular machine was not setup to automatically re-start the DCE software. This change of state was detected by the Configuration manager and represented on the display by changing the colour of the icon representing that host.

In addition, hosts can be configured remotely, from the Configuration Manager. The only configuration function that was tested was the ability to synchronise DTS on all the hosts. This feature worked as expected and was able to synchronise the hosts in the cell to within less than a second.

5. Conclusions

The HaL Cell Manager has been evaluated and found to be a useful tool for easing the burden of DCE cell administration. Several problems and potential problems with the Cell Manager have been identified, including:

- Lack of integration of the user interface components.
- No timestamps in log files.
- No capability to measure and graph status or performance against time.

Some potential problems are:

- Consistency of the Cell Manager and associated agent software with updates to DCE and related utilities on many platforms.
- Lack of scalability, as seen by the length of time taken to load the Namespace and Security Managers, and delete 1000 principals.

Although DCE cell management and Distributed Systems Management in general are still immature technologies, the Cell Manager represents a major step in the right direction. It is expected that other DCE system management or system administration tools will be evaluated in the future, and compared to the Cell Manager.

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